## 1023-69 Spontaneous Echocardiographic Contrast (SpE) Associated With Mechanical Valve (MHV) Closure: Evaluation by TEE and an *In-Vitro* Comparison Between Two Different Mechanical Bileaflet and a Bioprosthetic Valves

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*Background:* SpE is a poorly understood phenomenon with recent reports of a variety of bright echoes seen in patients with MHV. The present study was undertaken to review the TEE images of patients with prosthetic mitral valves and to compare and validate the clinical observations with *in-vitro* investigations. Our goals were to gain a better understanding of whether microbubbles are associated with a specific type of mitral valve prosthesis and to correlate this association with left ventricular function (LVF) and with the dynamics of the transvalvular flow.

*Clinical Methods:* Clinical data and TEE videotapes of all the patients with a prosthetic mitral valve between 1989 and 1995 were retrospectively reviewed.

*In-Vitro Methods:* A 27 mm *TEKNA* and a 31 mm *SJM* were studied in our pulsed flow simulator. For comparison, a 27 mm Porcine valve was also studied. A 23 mm Porcine was used as aortic valve. M-mode Doppler and 2D-echo were performed using a *Vingmed CFM750* ultrasound machine. An Argon-Ion laser beam was used for planar illumination and high-speed (HS) video imaging.

*Clinical Results:* Of 117 TEE studies (83 patients), 102 (71 patients) were available and adequate for review by 2 independent observers. Excluded were 15 studies (12 patients). Microbubbles were observed in 47 of 63 studies of SJM (74%), 7 of 12 studies with BS (58%), 4 of 4 studies of MH (100%) and 0 of 20 studies of bioprostheses (0%). Patients with estimated ejection fraction greater than 45% were found to have a higher percentage of studies revealing microbubbles.

*In-Vitro Results:* High-Speed imaging of transmitral flow depicted bright bubbles in the immediate vicinity of both mechanical valves. The nature of the bubbles was different in each valve. In the *TEKNA*, they were originating in the circumference and had a spherical shape. In the SJM, they originated in between the leaflets and had a stretched flame-like appearance. M-Mode and 2D-echo images best detected these bubbles. No bubbles were detected when a Porcine valve was studied.

*Conclusions:* In contrast to patients with tissue valves, microbubbles are a common phenomenon occurring in the LA of patients with MHV. The incidence of which seems to correlate with LVF and might suggest a *cavitation-like* process. *In-vitro* observations clearly indicated an association of SpE with MHV. Further studies yet to be performed to evaluate the clinical significance of the SpE.

## 1023-70 Inter-Machine Variability Affects Detection of Spontaneous Echo Contrast

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Spontaneous echo contrast (SEC) or "smoke", seen in low flow states (i.e., LA in AFib) is associated with thromboembolism. Thus, detection of SEC may determine whether anticoagulant therapy is initiated. To determine the technical variabilities in SEC detection, we imaged SEC generated from human whole blood in an in-vitro flow chamber with an Acuson (A) 7.5 MHz and 2 Hewlett-Packard (HP) (7.5 and 5.5 MHz) linear probes at varying log compressions, gain settings and 5 different B-color settings with the transducers fixed in position. Echo imaging was performed sequentially in a random fashion and stored on videotape for subsequent analysis. Videodensitometry (VD) was measured (Nova Microsonics) on an absolute scale of 0 (black) to 100 (white). Interobserver correlation for SEC VD in 63 video images was excellent (r = 0.99).

| B-Color | A/HP | MHz | Log | Gain | VD |
|---|---|---|---|---|---|
| Gray | A | 7.5 | 40 | 10 | 66.8 |
| Gray | HP | 7.5 | 65 | 95 | 20.4 |
| Gray | HP | 5.5 | 90 | 90 | 33.4 |
| Sepia | A | 7.5 | 30 | 15 | 75.1 |
| Sepia | HP | 7.5 | 60 | 95 | 16.9 |
| Sepia | HP | 5.5 | 65 | 100 | 23.6 |

There was a wide range of VD between the 2 machines for identical solutions and similar B-color settings. The highest VD's were: Acuson 7.5 MHz, temperature B-color, log 30, gain 15 generated a VD of 82.3; HP 7.5 MHz, rainbow at 75 log, gain 90, measured VD = 22.6; and HP 5.5 MHz, gray scale, log 90, gain 90, produced VD = 33.4. Thus, because of lack of industry standardization, SEC detection is extremely dependent on machine and technical variables which may have significant clinical implications.

## 1023-71 Spontaneous Echocardiographic Contrast in the Thoracic Aorta Predicts Future Myocardial Infarction and Cardiac Mortality

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While spontaneous echocardiographic contrast (SEC) detected within cardiac chambers by transesophageal echocardiography (TEE) has been associated with an increased risk of thromboembolism, less is known about SEC detected within the thoracic aorta (AEC) and its relationship to coronary artery disease (CAD) progression. Therefore, we assessed 118 consecutive male patients (pts) who underwent TEE and found AEC without dissection in 25 (21.2%). To consider AEC present, swirling echodense shadows distinct from high-gain artifact had to be agreed upon by 2 of 3 independent observers. Indications for TEE, coronary risk factors (hypertension, diabetes, smoking), incidences of reduced left ventricular ejection fraction (EF) and mitral regurgitation, and known CAD severity (1, 2, 3 vessel or left main) did not differ significantly between AEC+ and AEC– groups. Follow-up averaged 20.3 months (range of 18–25) and was 100% complete for mortality and 98% for morbidity. AEC+ pts were more likely to undergo a percutaneous transluminal coronary angioplasty (8.0% versus 1.1%, $p < 0.05$) and had a higher incidence of cerebrovascular events (44.0% versus 31.5%, $p < 0.24$). AEC was an independent predictor of myocardial infarction (16.0% versus 2.2%, $p < 0.005$) and cardiac death (20.0% versus 1.1%, $p < 0.0001$) and remained significant after covarying for age, EF, coronary risk factors, aortic disease (aortic dimension, atheromatous plaque, aneurysm) and SEC in the left atrium. We conclude that AEC is a common and important clinical marker that predicts a poor long-term cardiac prognosis.

## 1023-72 Epicardial Coronary Artery Response to Maximal Arteriolar Vasodilation Parallels Myocardial Hypertrophy in Endurance Athletes: A Transesophageal Echo Study

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Coronary flow reserve (CR) is commonly estimated as the ratio of coronary flow after maximal coronary vasodilation and resting flow. Using Doppler technique, either intracoronary or transesophageal (TEE), this measurement is usually approximated as the ratio of maximum coronary flow velocity (CFV) to basal velocity. Such a simplification relies on the assumption that the epicardial artery lumen diameter does not change after arteriolar vasodilation. Aim of this study was to assess the possible changes in the diameter of left main coronary artery (LMA) after maximal coronary vasodilation in man by means of 2-D TEE. LMA diameter was measured basally and after i.v. infusion of high-dose dipyridamole (0.84 mg/kg/9 min) in 67 subjects including 15 healthy normals (N), 26 hypertensive pts with LVH (H), 12 pts with intermediate LAD stenosis (LAD), and 14 endurance athletes (A) of comparable age. Measurements were performed from zoomed digitized diastolic images.

Results: LMA diameter at baseline and the percentage of LMA increase after dipyridamole were significantly higher in athletes as compared to the other groups ($4.4 \pm 0.3$ vs $3.9 \pm 0.4$, $3.9 \pm 0.7$, $3.9 \pm 0.4$ mm, $p < 0.05$ and $14.0 \pm 5$ vs $5.9 \pm 5.5$, $5.8 \pm 8$, $4.3 \pm 6\%$, $p < 0.01$). A direct correlation between the increase in LMA diameter after dipyridamole and the diastolic thickness of interventricular septum was observed in A ($r = 0.67$, $p < 0.01$), but not in other groups.

Conclusions: dipyridamole-induced arteriolar dilation was associated with negligible dilation of the epicardial vessel in most of subjects; however, in endurance athletes the increase in LMA diameter after dipyridamole was significant. Thus, CR expressed as a simple ratio of CFV underestimates coronary vasodilator capacity in these subjects. The response of the epicardial vessel diameter to maximal arteriolar vasodilation, consistent with an enhanced flow-mediated dilation, parallels the degree of physiologic LV hypertrophy in athletes.

## 1023-73 Transoesophageal Doppler Assessment of Severity of Left Coronary Artery Stenosis Based on the Continuity Equation. A Quantitative Coronary Angiography Validation Study

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The continuity equation applied to a stenosis states that the ratio of pre-